root from the internal tissues. It was not determined whether the root hairs grow between cell walls, into intercellular air spaces, or actually penetrate into the cells. The "fuzzy" appearance of the primary roots in figures 2 and 3 is an attempt to show this intimate association of the primary roots, root hairs, and internal fruit tissues after dissection.

One fact which seems to indicate that the root hairs are indeed the cause of this intimate association is that the root apex and some short distance behind it are completely free from any connection with the fruit tissues. This apparently is due to the absence of root hairs on such an immature part of the root.

Viviparous seedlings at a later stage than that shown in figure 1 have not been observed *in situ*. Such seedlings when removed from the fruit and placed on moist filter paper in a covered petri dish quickly show the production of new roots from the hypocotyl region. Apparently if these seedlings were planted they would produce normal plants.

While a number of cases of vivipary were found in this *Cordyline* plant, the number would be less than 0.1 per cent of the total number of fruits on the plant. One wonders what special physiological conditions were present in these viviparous fruits which caused or allowed the germination of these seeds. Also in the cases where more than one seed was present in a viviparous fruit, one wonders why only one seed germinated. One final question would be whether this condition occurs in this species in its native New Zealand, and what possible adaptive value might be found there for this condition, if it does occur.

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STUDIES ON SECOTIACEOUS FUNGI VI. SETCHELLIOGASTER POUZAR

Rolf Singer and Alexander H. Smith[1]

As a result of studying the types of *Secotium tenuipes* Setchell, and *Secotium aurantium* Zeller, we believe it is logical to group these two in a single genus as designated in our title. They have the following characters in common: their spores are some shade of rusty ochraceous, have an imperfect but often distinctly discontinuous pore-region, are elongate in shape, and smooth or ornamented by plugs of material filling canal-like passages through the wall. The hyphae bear clamp connections at the

[1] Papers from the University of Michigan Herbarium and the Department of Botany, No. 1086, University of Michigan, Ann Arbor, Michigan.

cross-walls and the mature gleba does not become pulverulent. The outer layer of the peridium is a layer of enlarged to vesiculose cells. The hymenophoral trama (tramal plates of the gleba) is regular, but in the region next to the subhymenium it is composed of characteristically enlarged cells often taking the shape of sphaerocysts.

The subhypogeous habitat, its presence in the forest duff in mild climates, the presence of gastroid basidia and spores, and possibly the bright color (or the absence of pigment) in the peridium are also features of the genus, but these characters do not necessarily separate it too sharply from other secotiaceous genera.

The spore characters and the structure of the outer layer of the peridium are very distinct from those of *Secotium* as represented by the type, *S. gueinzii,* and do not allow these species to be placed in any other segregate of *Secotium*. The generic name *Setchelliogaster* was proposed by Pouzar for the type species (*Secotium tenuipes* Setchell) just after we had submitted for publication our own account in which a new generic name was proposed for the two species treated below; therefore we have had to adapt our paper to the use of Pouzar's name, *Setchelliogaster.*

SETCHELLIOGASTER Pouzar, Ceská Mykologie 12:33. 1958.

Spores varying from light brownish to dark rusty ochraceous, with a germ pore which is mostly distinct, more rarely imperfect (or at least spore wall at apex of spore partly discontinuous), elongate, smooth or with an ornamentation of the type of *Metraria insignis* (part of spore wall conspicuously heterogeneous consisting of a continuous wall through which extend minute canals plugged by a resinous substance, these plugs appearing as dots or lines or imperfect reticulation on the paler ground when spore surface is focussed upon); clamp connections present; peridium covered by an epithelium; hymenophoral trama regular but showing some inflated elements and spherocysts near the subhymenium. Peridium russet brown or orange or rarely ivory color; gleba brownish; columella percurrent; stipe not voluminous. Basidium-spore-configuration of the gastromycetoid type. Among thermophilous vegetation, growing subhypogeously in humus under trees.

Type species of the genus: *Secotium tenuipes* Setchell.

SETCHELLIOGASTER TENUIPES (Setchell) Pouzar, Ceská Mykologie 12:34. Figs. 1–3. 1958. *Secotium tenuipes* Setchell, Jour. Mycol. 13:239. 1907.

Gastrocarp 10–30 mm. tall, and 10–30 mm. broad, subglobose or broadly ovoid, subumbonate, at the base more or less truncate.

Peridium membranous in lower (marginal) portion, up to 1 mm. thick further up, and rather thick at the point of confluence with the columella, glabrous, not viscid, yellow-brown, deep brown (according to Setchell), or red-brown ("Morocco red" R. according to Zeller), usually dehiscent from the stipe-columella to expose a narrow ring of gleba.

Gleba variable in structure, loculate with very regular (in shape and position) chambers which become slightly lammellarly extended near the

exposed portion below, in other specimens generally with a gill-like structure especially visible in longitudinal sections of the gleba, and then consisting of anastomosing plates resembling those of *Polyporus alveolarius* but not in a regular manner and not permitting the shedding of spores, chambers sinuous or equal or completely irregular, gleba decurrent on the apex of the stipe-columella but for the most part dehiscent or free from the latter, ochraceous brown.

Stipe variable in length, reaching 20 mm., relatively thin, often bent or flattened, more or less concolorous with the pileus, striate, solid, equal or slightly attenuate downward, 2–3 mm. thick; columella continuous with stipe, percurrent and widened into the upper portion of the peridium, sometimes slightly narrowed before reaching the junction, lower portion to over half the lower length free from gleba; volva none; veil superior, arachnoid, transverse, scanty, evanescent after maturity is reached. Context fleshy, odorless.

Spores 14.5–19 × 9.5–12.5 μ, ellipsoid to subovoid, shape in optical section slightly more ventricose on the outer line than on the inner one, but without a suprahilar applanation or depression, and not so strongly asymmetric generally as in agaric spores, deep rusty ochraceous viewed in KOH, structure of wall complex at maturity and 1–1.2 μ thick. Perisporium conspicuous and pale ochraceous-tawny. Exosporium heterogeneous, consisting of a continuous wall through which extend minute canals plugged by a resinous golden tawny substance, these canals at the surface of the perisporium appearing as dots or elongated irregular lines which may be fused to form an imperfect inconspicuous reticulation which appears tawny on a paler background, under mechanical pressure the combined exosporium and perisporium tending to separate from the episorium. Episporium tawny and appearing as a thin line. Endosporium interior to the episporium, thick and much paler in color than the latter. Spore apex complex and peculiar in structure: germ pore generally either poorly developed or absent but at times a perforation clearly visible, with a tawny-cinnamon, plug-like, thick, heterogeneous (different from wall-material) body in the region where the pores should be (abnormal spores often with 2–5 such structures), at times showing a slightly mucronate apical callus but no distinct perforation (a discontinuity of the wall strata may be observed only in the endo- and episporium), not truncate at apex, not necessarily germinating through the apex (lateral germination observed).

Basidia 30–40 × 7–10 μ, (1–) 2– (3–)-spored, hyaline, numerous but rarely seen to form a large area of hymenium but rather intermixed with very numerous pseudoparaphyses, with a median constriction; sterigmata apical, straight or very slightly curved (not typically half-sickle-shaped but rather of gastroid type); pseudoparaphyses normally vesiculose and not projecting beyond the general level of the hymenium, hyaline, sometimes gigantic (cystidia?), about 32 × 16 μ, generally 20–22 × 13 μ; true cystidia or pseudocystidia none seen.

Subhymenium well-developed, subhyaline to hyaline, consisting of small irregular elements, some of them subisodiametric, forming a distinct if not very thick layer; hymenophoral trama consisting of brownish to brownish-hyaline hyphae of very variable diameter, some of them actually subisodiametric (e.g. 4–28 μ diam.), thin-walled or nearly so, some elements incrusted by deep rusty pigment, generally regular but chains of broad inflated elements alternating with strands of filamentous narrow hyphae, making the trama slightly intermixed, and reminding one of the gill trama of *Conocybe*. Peridial tissue thin, inner layer much like the hymenophoral trama, not gelatinous, its hyphae 5–27 μ broad; outer layer thick, its elements rusty brown from incrusting pigment, an epithelium or pseudoparenchyma consisting of spherocysts in chains or isolated, and few filamentous hyphae ending up (as a terminal member) in a spherocyst (spherocysts 8–28 (50) × 8–22 μ) hyphae of all tissues with clamp connections.

Subhypogeously on earth and humus under *Eucalyptus globulus, Quercus* sp., etc., in California, U.S.A., fruiting during the rainy season (November until April), in Oregon also in June.

Material studied. California. Alameda County: University of California campus, Berkeley, Dec. 12, 1904, *Gardner 229* (holotype, UC 221827), MICH. Topotypes: 25 March 1911, *Nichols,* MICH, NY (distributed as UC Herbarium Exsiccata 399); March 10 and April 11, 1911, *Harper,* NY; fall, 1923, *Parks,* NY; April 10, 1935, *Copeland* (det. E. E. Morse), NY; February and March, 1931, *Morse,* NY. Santa Clara County: Alma, March 2, 1919, *Parks Z9,* NY; Stanford University campus, March 5, 1942, *Cooke & Doty 16619,* MICH. Also material preserved at FH from same regions as above. Oregon: Corvallis, *Zeller,* NY.

Illustrations: Setchell (1907), pl. 107, figs. 4–8. Lloyd, Myc. Notes V:788, fig. 1184. Heim, Rev. Myc. 25:21. 1950. figs. 1–18.

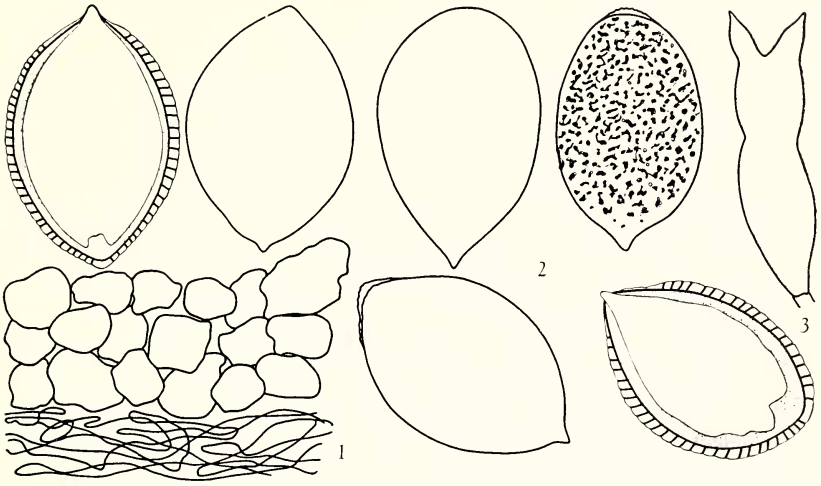
Setchell, in his original description, mentions the doubts he felt when publishing this species in *Secotium*: "In appearance and structure, this species varies so much from *S. Guienzii,* the type of the genus, that it may well be doubted whether it will ultimately be considered cogeneric with it, but, at present, it seems best to refer it to *Secotium* rather than attempt to split up that genus." We, on the other hand, find it rather amazing that between 1907 and 1957, in over half a century of mycological progress, no such attempt has been made.

Setchelliogaster aurantium (Zeller) Sing. & Smith, comb. nov. *Secotium aurantium* Zeller, Mycologia 39:292. 1947.

Gastrocarp 14 mm. broad, 15 mm. high, rounded umbonate above; peridium thin, not breaking from stipe-columella, bright orange, capucin yellow at base, gleba with small cavities, light brown.

Stipe terete, up to 3 mm. in diameter (about 20 mm. long), white, smooth, stuffed; columella also white, thin, percurrent; mycelium forming white rhizomorphs at base reminding one of those of the phalloids. Context white.

Spores 12–13 × 7.5–8 μ, light brownish ochre, smooth, ellipsoid to ellip-



FIGS. 1–3. *Setchelliogaster tenuipes*: *1,* epicutis of peridium, × 450; *2,* spores, × 1000; *3,* basidium, × 450.

soid-fusoid, with many tiny oil droplets inside, with moderately thickened wall composed of at least two layers, the outermost one well-colored, but perisporium not noticeable and no ornamentation seen, symmetric, with a distinct germ pore in a continuous wall showing lighter different material, but not distinctly showing an opening, and not truncate.

Basidia 21–22 × 8.2 μ, with slightly oblique, conical, slightly curved sterigmata; pseudoparaphyses numerous, 19–20 × 12.5 μ; cystidia none seen.

Hyphae of the hymenophoral trama hyaline, the mediostratum regularly arranged and consisting of a strand of parallel or subparallel rather broad axillarly arranged hyphae, bordered on both sides by layers of spherocysts which become gradually smaller as the subhymenium and hymenium are approached, hyphae of the mediostratum 4–16.5 μ thick, spherocysts about 28× 22 μ; peridium consisting of hyphous elements which are hyaline and 3–16 μ thick, outermost layer of peridium divided from trama proper by a hypodermium-like layer which is not very sharply differentiated from both the outermost layer and the internal hyphous layer, but consists of spherocysts or broad swollen hyphae forming a pseudoparenchymatous tissue which, on its outer side carries a palisade of clavate to irregular, more or less erect to isodiametric elements with remarkably thick lemon-yellow walls (walls 1.5 μ thick), the claviform ones about 22 × 10 μ; all tissues with clamped hyphae.

On the ground, apparently in the forest, fruiting in summer, Cuba.

Material studied. Cuba, Santa Clara Prov. July 6, 1941, *W. L. White 803* (NY & FH), type.

This species differs from the other member of the genus in the structure of the spore wall which lacks any ornamentation, but the important character of the outer layer of the peridium places the species in this genus. The microscopic data given in the description are taken from the type, but most of the macroscopic data are from the original description.

There is no other genus of secotiaceous fungi known at present with a cellular outer peridial layer such as found in either of these two species. *Weraroa* has a different peridial structure and its spores have a broader truncate apex.

As for the affinities of this genus with representatives of the Agaricales, we would say that it is even more closely related to the family Bolbitiaceae than *Galeropsis* which lacks a cellular outer layer of the peridium. While the habit is definitely more reminiscent of *Conocybe* in *Galeropsis* than in *Setchelliogaster,* the latter has also some similarity with such species as the fleshier *Agrocybes, Conocybe intrusa,* etc. The species with ornamented spores may be compared with such forms as are now combined in the subgenus *Ochromarasmius* of *Conocybe* where there is also a somewhat protruding germ pore. As a smooth-spored species, *Setchelliogaster aurantiacum* would be comparable with some of the more thin-walled representatives of *Conocybe* such as have been described in Kühner's monograph. The color of the peridium in this species does not seem to be rare in *Conocybe.* Finally, the relatively voluminous hyphal elements making up the hymenophoral trama are distinctive both for this species and in *Conocybe* where they may serve as a generic character separating this genus from the neighboring genera of the family Bolbitiaceae. It may be added that careful observation always reveals the existence of numerous pseudoparaphyses in the hymenia of *Setchelliogaster* as well as in *Conocybe* and *Bolbitius.* The spores of *S. tenuipes* are sometimes observed to be forked or otherwise misformed or doubled. Such monstrosities are common in the genus *Conocybe* and also in some other bolbitiaceous genera.

In spite of all the congruence found between *Setchelliogaster* as a whole and the Bolbitiaceae as a whole, it cannot be denied that there are also features in this genus which recall similar features of agarics in other families such as the particular spore ornamentation of *S. tenuipes.* This remarkable structure was noticed by Singer (1951) and attention was drawn to the partly agaric-like characters. Although the species was then characterized as agaricoid, no attempt was made to link it up with any particular group of agarics, a task which has become easier now that more species of *Secotium* have become known more thoroughly.

The ornamentation of *Setchelliogaster tenuipes* is not exactly duplicated by any known bolbitiaceous species. It is found, with slight variations, in *Ganoderma* among the "polypores", and in widely separated species and groups of species of the Agaricales such as *Boletellus, Metraria, Fayodia* (a genus considered as part of *Mycena sensu lato* by A. H. Smith), by a species described as *Tubaria thermophila* by Singer, and

another described as *Kuhneromyces alpinus* by Smith.[2] A similar spore type has been observed by us in the type of *Secotium eburneum* Zeller, but at present we do not wish to transfer that species to *Setchelliogaster* because the cellular layer of the peridium is overlaid by a layer of gelatinous filamentous hyphae forming a pellicle which is the outermost layer of the peridium.

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CEANOTHUS SEEDS AND SEEDLINGS ON BURNS

Clarence R. Quick[1]

Blue Canyon, the large rocky canyon of Big Creek, a tributary of Kings River, lies in the Sierra Nevada just southeast of Shaver Lake, Fresno County, California. This canyon once supported a magnificent stand of timber and in spots still does. Portions of the northerly part of the canyon were logged with "steam donkeys" around 1915. The ecologic course of reforestation on logged or burned forest areas, especially on high-quality forest sites, is often interesting and significant. Causes for variations in the reforestation process are not fully understood even yet.

The areas of Blue Canyon logged in 1915 were clear-cut, but somehow the methods used in the logging, the weather cycle after the logging, or perhaps other and unrecognized factors caused the cutover area to regenerate timber species promptly, especially sugar pine. For a while the new growing forest was somewhat brushy, but the brush slowly gave way to the competition of the trees, mostly pine trees, and by 1945 the old cutover area in the northeast corner of Blue Canyon was a beautiful stand of pole-sized sugar pine, ponderosa pine, white fir, and incense-cedar. Sugar pine predominated in much of the stand. Some decadent brush persisted, largely in the forest openings. On a one-acre study plot in the northwest corner of section 14, T10S, R25E, were found some 180 sugar pines, mostly pole-sized trees 4 to 12 inches in diameter.

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[2] This latter seems to be congeneric with *Melanomphalia nigrescens* and *M. platensis*. Singer (1955) placed *Melanomphalia* in the Cortinariaceae, and (1957) proposed the combination *Melanomphalia alpina* (Smith) Sing.